

ROUTER

RELATED APPLICATIONS

5 This application is a continuation of U.S. Application Serial No. 09/927,448
filed August 11, 2001, which claims the benefit of U.S. Provisional Application Serial
No. 60/224,852 filed August 11, 2000.

FIELD OF THE INVENTION

10 The invention relates to hand-held power tools and, more particularly, to
routers.

BACKGROUND OF THE INVENTION

15 A router generally includes a base for supporting the router on a workpiece
surface, a housing supported by the base and movable relative to the base, and a
motor supported by the housing and operable to drive a tool element. In a fixed-base
router, the housing is fixed or locked in a position relative to the base once the depth
of cut of the tool element is set. In a plunge router, the housing is movable relative to
the housing to the desired depth of cut so that the tool element "plunges" into the
workpiece.

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SUMMARY OF THE INVENTION

25 Typically, existing routers include one or more hand grips spaced apart on
opposite sides of the housing or the base to control movement of the router on the
workpiece. Many operators, however, grip a router by the housing or the base. A
typical router is manufactured from hard plastic or metal, which provide minimal
friction and lack of comfort to the operator.

30 The apparatus and method of the present invention alleviates, in aspects of the
invention, one or more problems relating to, among other things, gripping of the
router, depth adjustment, clamping of the housing relative to the base, operation of the
router in an inverted position and storage of the router.

In some aspects, the invention provides a hand grip connected to the housing.
In some aspects, the invention provides a router operable above a workpiece and

under a table. In some aspects, the invention provides a case for a router including a base plate operable to support a router with a bit attached.

5 In some aspects, the present invention provides a router including a hand grip attachable to one of the base and the housing, and the hand grip may be contoured to fit a hand of an operator and may be at least partially formed of an elastomeric material.

10 In some aspects, the router includes a fixing assembly for fixing the housing in a position relative to the base, the fixing assembly including a clamping member for applying a clamping force to the housing to fix the housing in a position relative to the base, and an actuator for moving the clamping member between a clamping position, in which the clamping member applies the clamping force to the housing, and a release position, in which the clamping force is not applied to the housing and the housing is movable relative to the base. Preferably, the actuator includes a plurality of cam members which are engageable to move the clamping member to the clamping position.

15 In some aspects, the router includes an adjustment mechanism for adjusting the position of the housing relative to the base. Preferably, the adjustment mechanism includes a coarse adjustment assembly, for making relatively large changes in the position of the housing relative to the base, and a fine adjustment assembly, for making relatively small changes to the position of the housing relative to the base.

20 In some aspects, the invention provides a router that is operable under a table and includes a housing, a base and an adjustment mechanism for adjusting the position of the housing relative to the base when the router is under the table.

25 In some aspects, the invention provides a case for a router including a base plate operable to support the router with a bit attached in the case and on a work surface.

30 Independent features and independent advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, claims, and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a router embodying aspects of the invention.

Fig. 2 is a perspective view of the router shown in Fig. 1 with portions removed.

Fig. 3 is a perspective view of the router shown in Fig. 2 and illustrating an exploded view of a clamping mechanism.

Fig. 4 is a enlarged perspective view of an actuator shown in Fig. 3.

Fig. 5 is a enlarged perspective view of a cam block shown in Fig. 3.

5 Fig. 6 is a perspective view of the hand grip for the router shown in Fig. 1 and illustrated in a removed condition.

Fig. 7 is an exploded perspective view of the router shown in Fig. 1 and illustrating a depth adjustment mechanism.

Fig. 8 is a perspective view of a lock frame shown in Fig. 7.

10 Fig. 9 is another perspective view of the lock frame shown in Fig. 7.

Fig. 10 is a perspective view of a depth adjustment shaft and knob shown in Fig. 7.

Fig. 11 is a partial cross-sectional view of the router taken generally along line 11--11 in Fig. 1.

15 Fig. 12 is a partial cross-sectional view of the router taken generally along line 12--12 in Fig. 11.

Fig. 13 is a perspective view of the router shown in Fig. 1 and illustrating operation of the router in an inverted position.

Fig. 14 is a perspective view of a router case.

20 Fig. 15 is a perspective view of router case shown in Fig. 14 and illustrating removal of the base plate.

Fig. 16 is a perspective view of the base plate.

Figs. 17-19 are perspective views of the base plate and the router and illustrating installation of the base plate on a support surface.

25 Before at least one embodiment of the invention is explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other
embodiments and of being practiced or being carried out in various ways. Also, it is
30 understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items.

DETAILED DESCRIPTION

A hand-held router 20 embodying aspects of the invention is illustrated in Fig.

1. The router 20 includes a base 24 and a motor housing 28 movably supported by the base 24. The housing 28 supports (see Fig. 12) a motor 30 operable to drive a tool element (not shown) to cut a workpiece W. In the illustrated construction, the router 20 is a fixed-base router. However, in other constructions (not shown) and for aspects of the invention, the router 20 may be a plunge router.

As shown in Figs. 1-3, the base 24 includes a sub base or base plate 32 designed to interface with a work surface, such as the surface of the workpiece W.

The base 24 also includes a generally cylindrical annular sleeve 36 extending upwardly from the base plate 32. The sleeve 36 is preferably fastened to, but may be formed integrally with the base plate 32 and has a generally cylindrical outer surface 40.

A pair of knob-like handles 44 removably mountable on the base 24 on opposite sides of the sleeve 36. The handles 44 preferably include soft-grip material covering at least a portion of the handle 44 to provide extra friction for gripping.

As shown in Figs. 1 and 6, the router 20 also includes a hand grip 48 attachable to the base 24 of the router 20. The hand grip 48 is attachable to the outer surface 40 of the sleeve 36 by fasteners 52. The hand grip 48 includes an inner surface 60, complementary to and engageable with the outer surface 40 of the sleeve 36, and an outer surface 64, is generally arcuate in horizontal cross-section and surrounds a portion of the sleeve 36. The hand grip 48 subtends an angle around the outer surface of the base 24 of at least 180° and, preferably, of at least 240° or, more preferably, of at least 300°.

The outer surface 64 of the hand grip 48 is preferably contoured to ergonomically match the shape of an operator's hand engaging the hand grip 48 and, thus, gripping the router 20. At least a portion of the hand grip 48 may include a soft grip 68 preferably formed of an elastomeric or tactile material to increase gripping friction. The soft grip 68 may also reduce the amount of vibration passed from the router 20 to an operator. The hand grip 48 may also include a plurality of ribs, ridges, or slots 72 to increase gripping friction.

The hand grip 48 also includes a lip 76 extending radially outward from an upper edge of the hand grip 48. The lip 76 allows an operator to carry a portion of the weight of the router 20 on a side of the operator's hand (not shown) without relying

solely on a pinch-type grip. The lip 76 may also prevent upward movement of the operator's hand off of the hand grip 48.

5 It should be understood that, in other constructions, the hand grip 48 may have a different configuration. Also, the hand grip 48 may be replaced by another hand grip (not shown) having, for example, a different configuration and/or size or formed of a different material, as required by the operating parameters of the router 20 or by the preferences of an operator.

10 It should also be understood that, in other constructions (not shown), the hand grip 48 may be connected to the housing 28. For example, the hand grip 48 may be connected to an upper portion of the housing 28 and having a portion telescoping over the base 24. In another construction (not shown), the base 24 may be relatively short so that a majority of the housing 28 would be engageable by the operator without interference by the base 24. A separate support arrangement may provide support between the base 24 and the housing 28 without interfering with the hand grip 48
15 connected to the housing 28. Such constructions may be provided for a plunge-type router.

A hand strap 80 may be provided to assist an operator in gripping and controlling the router 20. The hand strap 80 passes over the back of the operator's hand and, in the illustrated construction, is made of a hook and loop fastener to allow
20 an operator to adjust the fit of the hand strap 80. The hand strap 80 is attached to the base 24 on one end and to the lip 76 of the hand grip 48 on the other end. In other constructions (not shown), the hand strap 80 may be connected to the router 20 at other suitable points.

25 The sleeve 36 of the base 24 also has (see Fig. 12) an inner surface 84 which may be slightly tapered outward in an upward direction. The sleeve 36 is somewhat resilient and (see Figs. 2-3) is open on one side at a vertical seam 88. As a result, the inner diameter of the sleeve 36 may be increased or decreased by opening or closing, respectively, the seam 88. The resilience of the sleeve 36 results in the seam 88 being partially open when no force is applied to close the seam 88.

30 As shown in Figs. 2-3 and for some aspects of the invention, the router 20 is a fixed-base router and also includes a clamp mechanism 92 to control the opening and closing of the seam 88. When the seam 88 is generally closed, the base 24 is in a clamped position, in which the position of the housing 28 relative to the base 24 is fixed. When the seam 88 is open, the base 24 is in a released position, in which the

housing 28 is movable relative to the base 24. The clamp mechanism 92 includes a clamp pocket or receptacle 96 formed on the sleeve 36 on one side of the seam 88. The clamp receptacle 96 has an aperture therethrough. The clamp mechanism 92 also includes a clamp-receiving block 104 formed on the sleeve 36 on the other side of the seam 88. The clamp-receiving block 104 includes a blind recess therein (not shown).

As shown in Figs 3-4, the clamp mechanism 92 also includes an actuator or clamp handle 106 including a gripping portion 108 and a cam portion 112. A plurality of cam members 116 are affixed to or formed on the inner face of the cam portion 112, and each cam member 116 has a cam surface 120. As shown in Figs. 3 and 5, the clamp mechanism 92 also includes a generally square cam block 124 received in the clamp receptacle 96. A plurality of cam members 128 having cam surfaces 132 are formed on the outer surface of the cam block 124.

As shown in Figs. 1-3, a clamping pin 134 connects the components of the clamp mechanism 92. The pin 134 extends through the cam portion 112 of the clamp handle 106, through the cam block 124, through the clamp receptacle 96, and into a recess (not shown) in the clamp-receiving block 104. The pin 134 is anchored within the recess in the clamp-receiving block 104.

The clamp handle 106 can rotate about the pin 134, but the cam block 124 is restricted from rotation by the clamp receptacle 96. As the clamp handle 106 is rotated about the pin 134, the cam surfaces 120 of the cam members 116 interact with the cam surfaces 132 of the cam members 128.

When the seam 88 is open, the clamp handle 106 is in a generally horizontal orientation, and the cam members 116 of the clamp handle 106 are radially displaced from the cam members 128 of the cam block 124. In such a position, the cam members 116 generally alternate with the cam members 128 allowing the seam 88 to be open. When the seam 88 is open, the clamping force applied by the base 24 to the housing 28 is reduced so that the housing 28 is movable relative to the base 24.

To close the seam 88, the clamp handle 106 is rotated into a generally vertical position. As the handle 106 is rotated, the cam surfaces 120 interact with the cam surfaces 132, forcing the cam members 116 and the cam members 128 into radial alignment, increasing the distance between the clamp handle 106 and the cam block 124. Because the pin 134 is anchored in the clamp-receiving block 104, this increase in distance is taken up by the seam 88, forcing the clamp receptacle 96 closer to the

clamp-receiving block 104 and closing the seam 88. When the seam 88 is closed, the clamping force is increased to fix the housing 28 in a position relative to the base 24.

As shown in Figs. 2 and 12, the housing 28 is generally vertically oriented and has a generally cylindrical outer surface. The housing 28 supports the motor 30 and associated components. The motor 30 includes a shaft 138, and a tool holder, such as a collet 142, is connected to or formed with the shaft 138. The tool element is supported by the collet 142.

The housing 28 is arranged to fit within the sleeve 36 and to be vertically movable relative to the sleeve 36. Closing the seam 88 using the clamp mechanism 92, as described above, causes the inner surface 44 of the sleeve 36 to engage the outer surface of the housing 28 and to restrict the vertical movement of the housing 28. Opening the seam 88 releases the housing 28 and allows the housing 28 to be moved vertically.

As shown in Figs. 7 and 11-12, the base 24 defines a depth adjustment column 146 adjacent the clamp-receiving block 104 and is preferably formed integrally with the sleeve 36. The depth adjustment column 146 is generally hollow and has (see Fig. 7) an open top end.

As shown in Figs. 7 and 11, the base 24 also defines a lock mechanism receptacle 150 in the sleeve 36 above the depth adjustment column 146. The lock mechanism receptacle 150 includes an open end and an aperture, and the aperture is vertically aligned with the open top end of the depth adjustment column 146.

As shown in Figs. 7 and 12, the housing 28 includes a first depth adjustment interface 204 at the upper end of the housing 28. The first depth adjustment interface 204 includes a vertically-oriented aperture 208 therethrough which is vertically aligned with the aperture in the lock mechanism receptacle 150 and the opening 120 in the depth adjustment column 146.

The housing 28 also includes a housing cover 212 having a second depth adjustment interface 216. The second depth adjustment interface 216 includes a vertically-oriented aperture 220 therethrough which is vertically aligned with the aperture 208 in the first depth adjustment interface 204, the aperture 136 in the lock mechanism receptacle 150, and the open end of the depth adjustment column 146.

For some aspects of the invention, the router 20 also includes a depth adjustment mechanism 224 which cooperates with the housing 28 and the base 24 to

control the vertical position of the housing 28 relative to the base 24 and to thereby control the depth of cut of the tool element.

As shown in Figs. 7, 10 and 12, the depth adjustment mechanism 224 includes a depth adjustment shaft 228 which is generally vertically oriented and which has a threaded portion 232 generally housed within the depth adjustment column 146 and the lock mechanism receptacle 150. An adjustment knob 236 is attached to an upper end of the depth adjustment shaft 228. The lower end 238 has a non-circular cross-section, the reason for which is explained below in more detail. The depth adjustment shaft 228 is vertically fixed, but rotatable relative to the housing 28 and moves vertically with the housing 28 relative to the base 24.

A position indication ring 240, imprinted or otherwise marked with position-indicating markings 244, is attached to the second depth adjustment interface 216 by a plurality of resilient fingers 248 integrally formed with the position indication ring 240 so that the position indication ring 240 is fixed with but rotatable relative to the housing 28. The position indication ring 240 surrounds the depth adjustment shaft 228 and is positioned below the adjustment knob 236.

In other constructions (not shown), the position indication ring 240 may be attached to the housing 28 by other suitable structure. For example, the position indication ring 240 may be connected to but rotatable relative to the depth adjustment shaft 228.

As shown in Figs. 2 and 7-9, the depth adjustment mechanism 224 also includes a lock mechanism 252 enclosed partially within the lock mechanism receptacle 150. The lock mechanism 252 is vertically fixed to the base 24 and is movable in a direction perpendicular to the axis of the depth adjustment column 146. The lock mechanism 252 includes a lock frame 256 having a lock button 260, engageable by the operator to move the lock frame 256, and defining a lock frame aperture 264, through which the threaded portion 232 of the depth adjustment shaft 228 passes.

The lock frame aperture 264 includes an inner surface 272 and at least one locking projection or thread-engaging lug 276 formed on the inner surface 272. The lug 276 is selectively engageable with the threaded portion 232. The lock frame 256 is movable between a thread-engaging position, in which the lug 276 engages the threaded portion 232, and a disengaged position, in which the lug 276 does not engage

the threaded portion. The lock frame 256 is biased outwardly to the thread-engaging position by a spring or other biasing member 278.

The depth adjustment mechanism 224 may be used to adjust the vertical position of the housing 28 relative to the base 24 in two modes. For coarse
5 adjustment, the lock button 260 is pushed inward against the biasing member 278, releasing the threaded portion 232 from engagement with the locking projection 276. The depth adjustment shaft 228 and the housing 28 are then free to move translatably in a vertical direction relative to the lock frame 256 and the base 24. Once the desired
10 vertical position of the depth adjustment shaft 228 and the housing 28 is achieved, the lock button 260 is released and the biasing member 278 again biases the lock frame 256 outward to the thread-engaging position and the locking projection 276 engages the threaded portion 232. Once the locking projection 276 is re-engaged with the
15 depth adjustment shaft 228, the depth adjustment shaft 228 and the housing 28 are restricted from free translational movement.

For fine adjustment, the lock mechanism 252 remains engaged with the depth
15 adjustment shaft 228. The adjustment knob 236 is rotated, thus rotating the depth adjustment shaft 228 and the threaded portion 232. The threaded portion 232 rotates relative to the locking projection 276 so that the depth adjustment shaft 228 and the
20 housing 28 move in relatively small increments in a vertical direction relative to the lock frame 256 and the base 24.

In operation, an operator often needs to adjust the depth of cut of the router 20.
To adjust the router 20 from a first depth of cut to second depth of cut, the operator
first releases the clamp mechanism 92, as described above. This action releases the
sleeve 36 from clamping engagement with the housing 28 and allows the housing 28
25 to be vertically moved relative to the base 24. Coarse adjustment of the position of the housing 28 relative to the base 24 is preferably performed first as described above. Fine adjustment of the position is then performed. Once the desired vertical position
is achieved, the operator clamps the clamp mechanism 92, thus clampingly re-
engaging the sleeve 36 with the housing 28 and substantially restricting the housing
30 28 from further movement relative to the base 24. The operator then operates the router 20 by grasping either the two knob-like handles 44 or the hand grip 48, as desired. Additional depth adjustments may be made by repeating this process.

As shown in Fig. 13, the router 20 can be supported in an inverted position below a support member, such as a table 280. The table 280 has an upper surface for

supporting a workpiece (not shown) and a lower surface to which the router 20 is connected. First and second apertures or openings 284 and 288 extend through the table 20. The first aperture 284 allows a tool element or cutting bit 290 of the router 20 to protrude above the table 280 so work can be done on the workpiece.

5 An adjustment member 292 is inserted into the second aperture 288 of the table 280 to facilitate adjustment of the cutting depth of the router 20 from above the table 280. The adjustment member 292 has a knob 294 engageable by an operator and a second end 296 engaging the lower end 238 of the depth adjustment shaft 228. The ends 296 and 238 have complementary engaging surfaces to rotatably connect the
10 adjustment member 292 and the depth adjustment shaft 228. As the adjustment member 292 is rotated, the depth adjustment shaft 228 rotates, thereby adjusting the height of the cutting bit 290 above the table 280. The adjustment member 292 alleviates the need to reach under the table to make fine height adjustments to the depth of cut of the router 20.

15 As shown in Figs. 14-19, the router 20 may be used in combination with a router case 300. The case 300 includes (see Figs. 14-15) hinged case walls 304 and 308 defining grooves 310 and a removable base plate 312 cooperating to define an interior 314 in which the router 20 may be positioned. In the illustrated construction, the lateral edges 316 of the base plate 312 are slidably received in the grooves 310 to
20 connect the base plate 312 to the case walls 304 and 308. However, in other constructions (not shown), the base plate 312 may be connected to the case walls 304 and 308 in another manner, such as, for example, by fasteners (not shown). Preferably, the case 300 is molded or formed of a suitable material to provide the necessary configuration to accommodate the router 20 and any accessories. The case
25 300 also includes a carrying handle 320.

 As shown in Figs. 14-19, the base plate 312 may be removed from the case 300 and may be connected by fasteners 322 to a surface S to support the router 20 on the surface S. The base plate 312 has an upper surface defining a central recess 324. The router 20 is supported with the lower surface of the base plate 32 engaging a
30 portion of the upper surface of the base plate 312 and with the cutting bit 290 received in the central recess 324. The router 20 can thus be conveniently stored in a work area ready-for-use with the cutting bit 290 still attached. The base plate 312 defines additional recessed areas 328 and 330 for conveniently storing additional cutting bits 332 and tools, such as wrenches 334, respectively. In the illustrated construction, the

fasteners 322 extend through the additional recessed areas 328 to connect the base plate 312 to the surface S.

One or more independent features of the invention are set forth in the following claims.